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Review of Dysmorphoptilidae HANDLIRSCH (Hemiptera: Cicadomorpha) from the Argentinean Triassic, with description of a new subfamily, and a new species

RAFAEL GIOIA MARTINS-NETO* & OSCAR FLORENCIO GALLEGO**

* Programa de Pós-graduação em Ciências Biológicas, Comportamento e Biologia Animal Universidade Federal de Juiz de Fora – UFJF Campus Universitário Martelos - 36036-900- Juiz de Fora, MG Brazil / Sociedade Brasileira de Paleoartropodologia - SBPr.; e-mail: martinsneto@terra.com.br; mtnsneto@icb.ufjf.br

** Paleontología (Facultad de Ciencias Exactas y Naturales y Agrimensura – Universidad Nacional del Nordeste) y Área Paleontología (Centro de Ecología Aplicada del Litoral – Consejo Nacional de Investigaciones Científicas y Técnicas), Casilla de Correo 128, 3400 Corrientes, Argentina; e-mail: ofgallego@hotmail.com, ofgallego@gmail.com

ABSTRACT. This contribution presents new fossil insect taxa of the order Hemiptera (Cicadomorpha, Dysmorphoptilidae, Gallegomorphoptilinae subfam. n.) from the Ischichuca Formation (late Middle Triassic to early Late Triassic) from La Rioja Province (Argentina). One subfamily, one new species, and three new combinations, are proposed: *Gallegomorphoptila kotejai* sp. n., *G. acostai* comb. n., *G. gigantea* comb. n., *G. pulcherrima* comb. n. Also, a wide review of the family Dysmorphoptilidae HANDLIRSCH (diverse and well represented in the Argentinean Triassic levels), is made.

KEY WORDS: Hemiptera, Cicadomorpha, Dysmorphoptilidae, Triassic, Argentina, new subfamily, new species, new combinations, palaeoentomology.

INTRODUCTION

In this paper, a fossil insect of the order Hemiptera (Cicadomorpha) from the Ischichuca Formation (Quebrada de Ischichuca Chica locality, La Rioja Province, Argentina) are described, as well as a wide review of the Family Dysmorphoptilidae Handlirsch (diverse and well represented in the Argentinean Triassic levels), is made.

The historical and previously described insects from Argentinean Triassic were extensively focused in GALLEGO (1997), GALLEGO et al. (2005), GALLEGO & MARTINS-NETO (1999), MARTINS-NETO & GALLEGO (1999, 2001) and MARTINS-NETO et al. (2003, 2005,

2006, in press).

MARTINS-NETO & GALLEGO (1999) described for the first time the presence of the hemipterous dysmorphoptilids, as *Dysmorphoptiloides acostai* MARTINS-NETO et GALLEGO, 1999, in the Triassic sequences from Argentina. MARTINS-NETO et al. (2003), described other two species (*D. gigantea* MARTINS-NETO et GALLEGO, 2003 and *D. pulcherrima* MARTINS-NETO et GALLEGO, 2003) of the same genus and erected a new genus *Gallegomorphoptila* MARTINS-NETO, 2003 with a new species (*G. breviptera* MARTINS-NETO, 2003). Also, in this paper the authors create a new genus and species from the Chilean Triassic sequence (Santa Juana Formation), *Bandelnielsenia chilena* MARTINS-NETO et GALLEGO, 2003. New analysis, added the discovery of the new material from the Ischichuca Formation, (*G. kotejai* sp. n. described below) allow us to transferred all of the species previously described from Argentina, under the genus *Dysmorphoptiloides* EVANS, 1956 to the genus *Gallegomorphoptila* gen. n. and erect two subfamilies Dysmorphoptilinae HANDLIRSCH sensu n. and Gallegomorphoptilinae subfam. n.

The samples from the Ischichuca Formation were first collected by RICARDO NESTOR MELCHOR (Universidad Nacional de La Pampa and Consejo Nacional de Investigaciones Científicas y Técnicas) in a field trip in 1995.

The terminology adopted here conforms to that of KUKALOVÁ-PECK (1991) for "Auchenorrhyncha".

The repository and institutional abbreviations used here are, PULR-I: Paleontology Collection, Museo de Ciencias Naturales, Universidad Nacional de La Rioja, La Rioja, Argentina. PZ-CTES: Paleozoological Collection, Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste, Corrientes, Argentina.

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SYSTEMATIC PALEONTOLOGY

Order Hemiptera LINNAEUS, 1758
Suborder Cicadomorpha MARTYNOV, 1926
Superfamily Prosboloidea HANDLIRSCH, 1906
Family Dysmorphoptilidae HANDLIRSCH, 1906

Subfamily Dysmorphoptilinae HANDLIRSCH, 1906 sensu n.

Diagnostic characters

Fore wing with RA with two or more secondary branches and unbranched RP; ra-rp present. Genera included: *Dysmorphoptila* HANDLIRSCH, 1906, *Tennentsia* RIEK, 1976 and *Mesoatracis* BECKER-MIGDISOVA, 1949. Triassic to Jurassic. Known species: *Dysmorphoptila liasina* HANDLIRSCH, 1906 (Jurassic, Germany), *Dysmorphoptila notodon* SHCHERBAKOV, 1988 (Jurassic, Mongolia), *Mesoatracis reducta* BECKER-MIGDISOVA, 1949 (Jurassic, Central Asia), "*Dysmorphoptiloides*" *parva* EVANS, 1956 (Triassic, Australia), and *Tennentsia protuberans* RIEK, 1974 (Triassic, Africa).

Gallegomorphoptilinae MARTINS-NETO subfam. n.

Diagnosis

Fore wing with RA and RP distally fused; ra-rp absent; unbranched RA; RP with two or three secondary branches. Genera included: *Dysmorphoptilioides* EVANS, 1956 (Triassic Australia), *Gallegomorphoptila* MARTINS-NETO in MARTINS-NETO, GALLEGO & MELCHOR 2003), (Triassic, Argentina) and *Bandelnielsenia* MARTINS-NETO et GALLEGO in MARTINS-NETO, GALLEGO & MELCHOR 2003 (Triassic, Chile).

Discussion

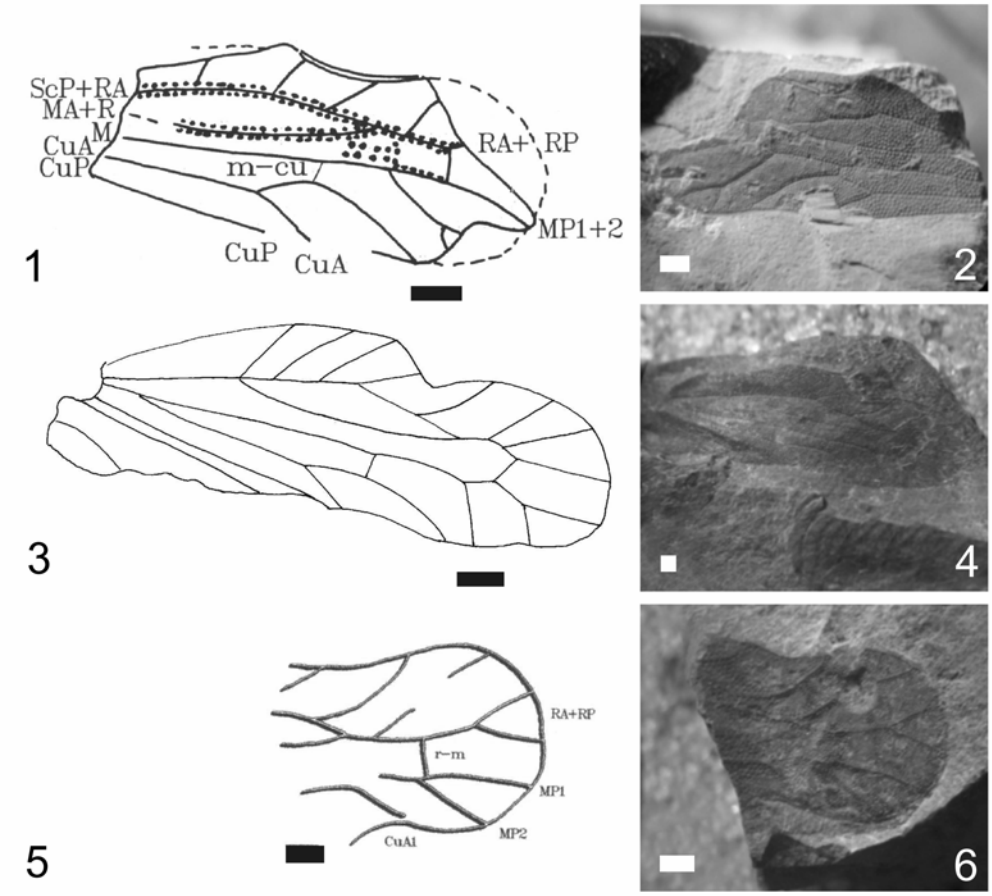
Gallegomorphoptilinae subfam. n. differs from Dysmorphoptilinae by having its constituent genera RA and RP distally fused (unfused in Dysmorphoptilinae), ra-rp absent (present in Dysmorphoptilinae) and RP with two to three secondary branches (unbranched in Dysmorphoptilinae).

***Gallegomorphoptila* MARTINS-NETO**
in MARTINS-NETO, GALLEGO & MELCHOR, 2003

Type species. *Gallegomorphoptila breviptera* MARTINS-NETO in MARTINS-NETO, GALLEGO & MELCHOR 2003: 240, Fig. 4H, by original designation.

Diagnostic characters

Fore wing with the last ScP secondary distally oblique to the costal margin. ScP and RA oblique to the costal margin forming a cell as long as wide.



Figs 1–6. 1 - *Gallegomorphoptila acostai* (MARTINS-NETO et GALLEGO, 1999), reproduced from MARTINS-NETO et al. 2003: Fig. 4G, 2 - *Gallegomorphoptila acostai* (MARTINS-NETO et GALLEGO, 1999), supplementary material, PZ-CTES n° 7200; figured in MARTINS-NETO et al. 2003: Fig. 4D, 3 - *Gallegomorphoptila kotejai* sp. n., drawn from holotype, 4 - *Gallegomorphoptila kotejai* sp. n., holotype, PULR-I 314, 5 - *Gallegomorphoptila gigantea* (MARTINS-NETO et GALLEGO, 2001), reproduced from MARTINS-NETO et al. 2003: Fig. 4G, 6 - *Gallegomorphoptila gigantea* (MARTINS-NETO et GALLEGO, 2001), holotype PULR-I 255; figured in MARTINS-NETO et al. 2003: Fig. 4G. Terminology: CuA, CuP, anterior and posterior cubitus, respectively; MA, MP, anterior and posterior media, respectively; RA, RP, anterior and posterior radius, respectively; ScP, posterior subcosta; m-cu, media-cubitus cross-vein; r-m, radius-media cross-vein. Scale bars: 1 mm.

Discussion

Gallegomorphoptila MARTINS-NETO, 2003 differs from *Dysmorphoptiloides* EVANS, 1956 by having fore wing with ScP distally oblique to the costal margin (straight and parallel in *Dysmorphoptiloides*) and ScP and RA oblique to the costal margin forming a cell as long as wide (parallel and forming a cell twice longer than wide in *Dysmorphoptiloides*).

Included species

Gallegomorphoptila breviptera MARTINS-NETO, 2003 (type species), *Gallegomorphoptila acostai* (MARTINS-NETO et GALLEGO, 2003) comb. n., *Gallegomorphoptila gigantea* (MARTINS-NETO et GALLEGO, 2003) comb. n., *Gallegomorphoptila kotejai* sp. n. and *Gallegomorphoptila pulcherrima* (MARTINS-NETO et GALLEGO, 2003) comb. n.

***Gallegomorphoptila acostai* (MARTINS-NETO et GALLEGO, 1999) comb. n.**
Figs 1 & 2

Dysmorphoptiloides acostai MARTINS-NETO et GALLEGO, 1999: 192, 194, Fig. 2A.
Dysmorphoptiloides acostai MARTINS-NETO et GALLEGO, 1999: MARTINS-NETO et al: 2003: 239, Figs 4B, C, D.

Diagnostic characters

Fore wing around 15 mm long, without colour pattern. RP_2 distally with a small dichotomy.

Holotype

PZ-CTES n° 5772.

Type locality

300 m west of Quebrada del Durazno, South of the Cerro Cacheuta, Mendoza, Argentina, levels EP I and EP II of MOREL (1994).

Stratum typicum

Upper Section of the Potrerillos Formation.

Age

Early Late Triassic.

Supplementary material

PULR-I 260 (MARTINS-NETO et al. 2003, Fig. 4C): fore wing basal fragment with 6 mm of the length preserved and PZ-CTES n° 7200, (MARTINS-NETO et al. 2003, Fig. 4D): fore wing fragment with 10 mm of the length preserved. Stratigraphical and geographical precedence as in the holotype.

Locality

Gualo, La Rioja Province, Argentina.

Stratum

Los Rastros Formation.

Age

Early Late Triassic.

***Gallegomorphoptila kotejai* sp. n.**
Figs 3 & 4

Diagnosis

Fore wing without colour patterns, around 15 mm long. R+M distally sigmoid at RP branching; three-branched RP; MP zigzag-like at r-m; MP_1 distally two-branched.

Etymology

In honour to memory of the late Professor Jan Koteja, great Polish palaeoentomologist.

Holotype

PULR-I 314.

Type locality

Quebrada de Ischichuca Chica, La Rioja province, Argentina.

Stratum typicum

Ischichuca Formation.

Age

Late Middle Triassic to early Late Triassic.

Discussion

Similar to *Gallegomorphoptila gigantea* comb. nov. by having three-branched RP (two-branched in all other species known for the genus), however differing, in the size and arrangement of such branches: longer RP1 and shorter RP2 and RP3 in *G. gigantea*, all of three with similar size in *G. kotejai* sp. nov. It differs from all known species by having R+MA distally sigmoid (slightly curved in *G. acostai*, *G. gigantea*, *G. breviptera* and *G. pulcherrima*).

Description

(Holotype PULR I 314, Fig. 1B) Fore wing 15.4 mm long and 5 mm wide. Costal and anal margin sigmoid, concave at apical margin boundary. Apical margin rounded. Costal area broad. Four-branched ScP. R+MA distally fused, after the level of concave area of the costal margin. Three-branched RP. MA+RP notably sigmoid at the RP secondary branches origin. Two-branched MP: two-branched MP_1; MP_{1a}, longer than MP_{1b}; unbranched MP_2. The r-m vein oblique, close to the apex. Two-branched CuA: CuA_1 curved and longer than CuA_2. CuA_1 and CuA_2 enclose the concave area of the anal margin. The m-cu vein relatively short. CuP long, straight, oblique to the anal margin. Anal area partially preserved. Colour pattern if exists, not preserved. The entire surface of wing rugose, with homogeneously granular surface.

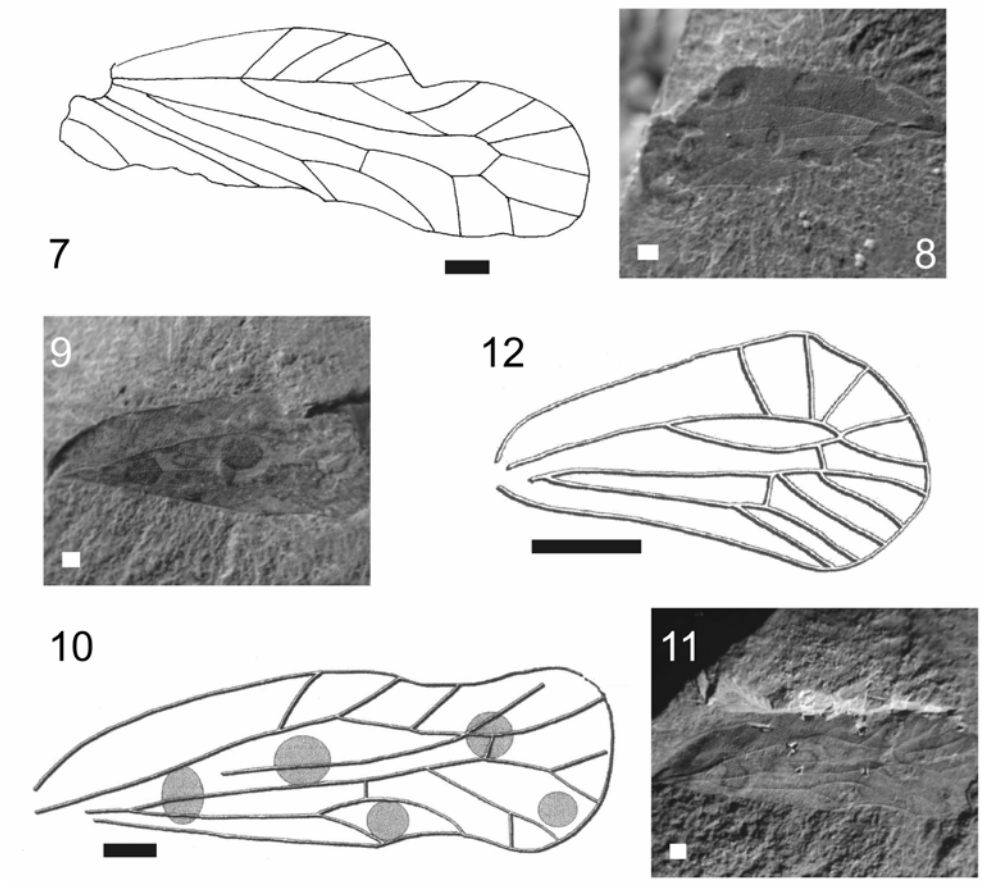
***Gallegomorphoptila gigantea* (MARTINS-NETO et GALLEGO, 2001) comb. n.**

Figs 5 & 6

Dysmorphoptiloides gigantea MARTINS-NETO et GALLEGO, 2001: 108, 109, pl. IC, fig. 1D.
Dysmorphoptiloides gigantea MARTINS-NETO et GALLEGO, 2001: MARTINS NETO et al. 2003: 239, 240, Fig. 4G.

Diagnostic characters

Fore wing apical area 10 mm long (total length around 30 mm). Three-branched RP; MP_1 and MP_2 distally undichotomous; r-m at M forks.



Figs 7–12. 7 - *Gallegomorphoptila breviptera* MARTINS-NETO, 2003 restored from MARTINS-NETO et al. 2003: Figs 4A, H, 8 - *Gallegomorphoptila breviptera* MARTINS-NETO 2003, holotype part PULR-I 265, figured in MARTINS-NETO et al. 2003: Fig. 4H, 9 - *Gallegomorphoptila breviptera* MARTINS-NETO, 2003, counterpart, PULR-I 254, figured in MARTINS-NETO et al. 2003: Fig. 4A, 10 - *Gallegomorphoptila pulcherrima* (MARTINS-NETO et GALLEGO, 2003), holotype, part, PULR-I 261; figured in MARTINS-NETO et al. 2003: Fig. 4E, 11 - *Gallegomorphoptila pulcherrima* (MARTINS-NETO et GALLEGO, 2003), reproduced from MARTINS-NETO et al. 2003: Fig. 4F, 12 - *Bandelnielsenia chilena* MARTINS-NETO et GALLEGO, 2003, reproduced from MARTINS-NETO et al. 2003: Fig. 6G and GALLEGO et al. 2005: Figs 2D, Pl. 3, Fig. 8. Terminology as in Figs 1–6. Scale bars: 1 mm.

Holotype

PULR-I 255.

Type locality

Gualo, La Rioja Province, Argentina.

Stratum typicum

Los Rastros Formation.

Age

Early Late Triassic.

Gallegomorphoptila breviptera MARTINS-NETO in MARTINS-NETO, GALLEGO & MELCHOR, 2003

Figs 7–9

Dysmorphoptiloides acostai MARTINS-NETO & GALLEGO, 2001: 108, Pl. IE, Fig. 1B.
Dysmorphoptiloides acostai MARTINS-NETO in MARTINS-NETO, GALLEGO & MELCHOR 2003: 239, Fig. 4A.
Gallegomorphoptila breviptera MARTINS-NETO in MARTINS-NETO, GALLEGO & MELCHOR 2003: 240, 242, Fig. 4H.

Diagnostic characters

Fore wing 14 mm long; RP1 and RP2 without distal branches. Ornamentation constituted by two spots of colour pattern, one at discoidal cell and another at basal part of the wing.

Holotype

PULR-I 265 (part) and PULR-I 254 (counterpart).

Locality

Gualo, La Rioja Province, Argentina.

Stratum typicum

Los Rastros Formation.

Age

Early Late Triassic.

Gallegomorphoptila pulcherrima (MARTINS-NETO et GALLEGO in MARTINS-NETO, GALLEGO & MELCHOR, 2003) comb. nov.

Figs 10 & 11

Dysmorphoptiloides pulcherrima MARTINS-NETO et GALLEGO in MARTINS-NETO, GALLEGO & MELCHOR, 2003: 240, Figs 4E, F.

Diagnostic characters

Fore wing 18 mm long. RP forks close to ScP+RA and R+MA fusion; MP_1 and MP_2 two-branched. Colour pattern constituted by five spots: at discoidal cell, at wing base, between CuA_1 and CuA_2, at RP forks and between MP_1 and MP_2.

Holotype

PULR-I 261 (part) and PZ-CTES 7326 (counterpart).

Type locality

Gualo, La Rioja Province, Argentina.

Stratum typicum

Los Rastros Formation.

Age

Early Late Triassic.

PHYLOGENETICAL ASPECTS OF THE DYSMORPHOPTILIDAE HANDLIRSCH

The first important recent discussion about the family Dysmorphoptilidae HANDLIRSCH, 1906 was provided by SHCHERBAKOV (1984), considering the Eoscartellidae EVANS, 1956 as synonymous of the former. The family Fulgoringruidae, with the oldest representative of the family, *Fulgoringruo kukalovae* PINTO, 1990 was described from the Iratí Formation sediments, at Rio Grande do Sul State (Permian, Paraná Basin) by PINTO (1990). It was included into Dysmorphoptilidae as a subfamily Fulgoringruinae PINTO, 1990 by SHCHERBAKOV (2000). SHCHERBAKOV & POPOV (2002) considers that the taxonomic placement of Dysmorphoptilidae has to be within Cicadomorpha: Prosboloidea.

The phylogenetical and systematic approach shows that the group is monophyletic and highly flourishing. Mainly in South America, the best record and account of specimens and named species can be found. The most ancient dysmorphoptilid stem known came from the Brazilian Permian, with *Fulgoringruo* (Fulgoringruinae), probable cradle of the entire group. The first post-Paleozoic record came from Australia with the *Trifidella*-type and *Dysmorphoptiloides*-type, as well as the *Dysmorphoptila*-type (Triassic). The South America Triassic dysmorphoptilids exhibit more advanced characters and a higher specialization pattern, as for example, more notorious ornamentation patterns. *Bandelnielsenia* MARTINS-NETO et GALLEGO, 2003, the most southwestern record of the group, although more specialized when compared with Australian specimens, exhibits low specialization degree when compared with the advanced *Gallegomorphoptila* species. The African record is still not well interpreted because it exhibits (apart from diagnostic Dysmorphoptilinae characters) a set of plesiomorphic characters very distinct from both Australian and South American, as well as European species. New possible findings in Brazil and Antarctic (until now without Triassic records of the group) might furnish the lack of elements to understand the phylogeny of the group more accurately. The stem "Eoscartellidae" is constituted by very plesiomorphic taxa within Dysmorphoptilidae and could belong to a proper subfamily, apart Fulgoringruinae, Dysmorphoptilinae and Gallegomorphoptilinae.

FINAL COMMENTS

The Hemiptera: Dysmorphoptilidae is one of the most typical insect group from the Triassic sediments of Laurasia as well as Gondwana, well-represented in Argentina and with wide paleogeographical and small stratigraphical distribution. One of these subfamilies clades, the Gallegomorphoptilinae (here proposed), is completely extinct in Gondwana after the Upper Triassic while the other clade, Dysmorphoptilinae, the sister group, survives until the Lower Jurassic in Laurasia, when it also vanishes from the geological record. *Gallegomorphoptila kotejai* sp. n. extends and so does the paleogeographic distribution of the Gallegomorphoptilinae subfam. n. in the Triassic of South America (Fig. 13).

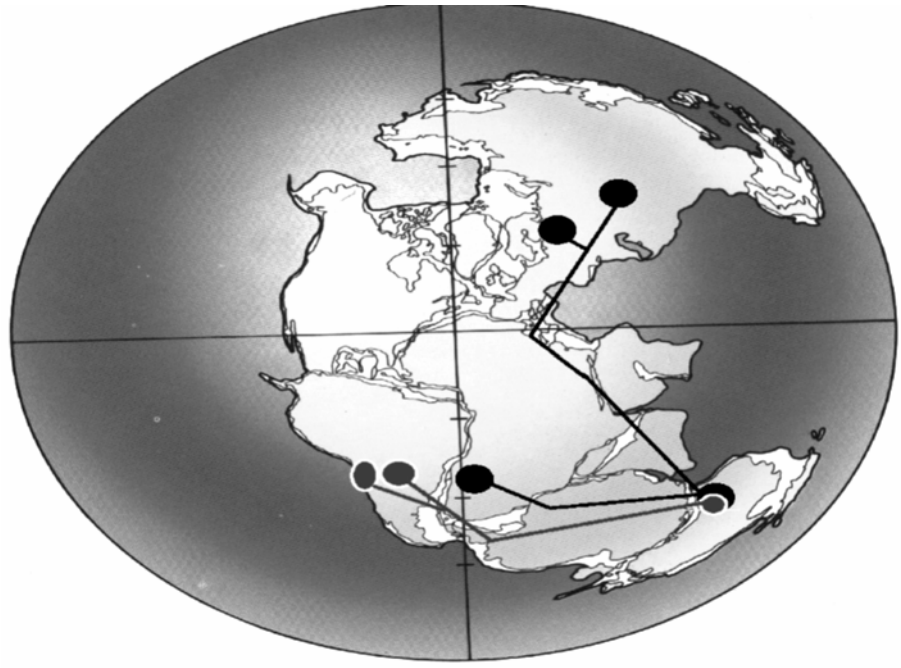


Fig. 13. Paleogeography of Dysmorphoptilidae HANDLIRSCH. Darker lines, shows the Dysmorphoptilinae distribution; lighter lines, the Gallegomorphoptilinae distribution. Triassic map adapted from CZERKAS & CZERKAS (1990).

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